

WE CLAIM:

1. An injectable liposomal composition for delivery of a water-soluble substance, the composition comprising:
a plurality of liposomal vesicles comprising a high weight ratio of a lipid to an encapsulated water-soluble substance so as to achieve a high efficiency of encapsulation.
2. The composition of claim 1, wherein the encapsulation efficiency is more than 50%.
3. The composition of claim 1, wherein the encapsulation efficiency is more than 80%.
4. The composition of claim 1, wherein the encapsulated substance is distributed over a plurality of liposomal vesicles.
5. The composition of claim 1 or 4, wherein the liposomal vesicles are multilamellar vesicles (MLV).
6. The composition of claim 1, wherein the water-soluble substance comprises more than one compound.
7. The composition of claim 1, wherein the water-soluble substance is selected from the group consisting of proteins, proteoglycans and carbohydrates.
8. The composition of claim 1, wherein the water-soluble substance comprises a vaccine.
9. The composition of claim 8, wherein the vaccine is directed against a hormone or hormone cognate receptor.
10. The composition of claim 8, wherein the vaccine comprises at least one hormone-immunomimic peptide or hormone receptor-immunomimic peptide which is conjugated to an immunogenic hydrophilic carrier protein.
11. The composition of claim 1, wherein the weight ratio of lipid to encapsulated substance ranges from about 50 to about 1000.
12. The composition of claim 1, wherein the weight ratio of lipid to encapsulated substance is about 300.
13. The composition of claim 10, wherein the immunomimic peptide is a synthetic sequence selected from the group consisting of gastrin G-17, gastrin G-34, GnRH, and hCG.
14. The composition of claim 13, wherein the synthetic gastrin G-17 sequence is SEQ NO: 1, or fragments thereof (SEQ ID NO: 3-8).
15. The composition of claim 13, wherein the synthetic G-34 peptide sequence is SEQ ID NO: 12.
16. The composition of claim 13, wherein the synthetic GnRH immunomimic peptide sequence is SEQ ID NO: 15.
17. The composition of claim 13, wherein the synthetic hCG immunomimic peptide sequence is SEQ ID NO: 16.

18. The composition of claim 1, wherein the liposome comprises liposome-forming lipids.
19. The composition of claim 18, wherein the liposome-forming lipids comprise a hydrophobic tail portion and a polar or chemically reactive portion.
20. The composition of claim 18, wherein the liposome-forming lipids comprise hydrocarbon chains or steroid tail group, and a polar head group.
21. The composition of claim 19, wherein the polar head group or chemically reactive portion comprise an acid, alcohol, aldehyde, amine or ester.
22. The composition of claim 18, wherein the liposome vesicle-forming lipids comprise phospholipids.
23. The composition of claim 22, wherein the phospholipids are selected from the group consisting of phosphatidic acid, phosphatidyl choline, phosphatidyl ethanolamine, phosphatidyl glycerol, phosphatidyl inositol, and sphingomyelin.
24. The composition of claim 1, wherein the liposome comprises at least 70 mole percent dimyristoyl phosphatidylcholine (DMPC).
25. The composition of claim 8, wherein the encapsulated vaccine has a dose of at least about 50 µg.
26. The composition of claim 9, wherein the encapsulated anti-hormone vaccine or anti-hormone receptor vaccine has a dose ranging approximately from 0.3 to 5 mg.
27. The composition of claim 10, wherein the immunomimic peptide is conjugated to the immunogenic carrier through a spacer peptide.
28. The composition of claim 27, wherein the spacer peptide is selected from the group consisting of SEQ NO: 9, 10, and 11.
29. The composition according to claim 1, wherein the liposomes encapsulate a water-soluble immunogen and a water-soluble high molecular weight immunomodulatory substance, either separately or together.
30. The composition according to claim 1, wherein the liposomes encapsulate a water-soluble low molecular weight immunomodulatory substance, either separately or together.
31. The composition according to claim 29, wherein the high molecular weight immunomodulatory substance comprises cytokines.
32. The composition according to claim 31, wherein the low molecular weight substance is selected from the group consisting of nor MDP, threonyl MDP, murabutide, N-acetylglucosaminyl-MDP, and murametide.
33. An aseptic composition comprising an injectable aqueous suspension of the composition of any one of the claims 8-17.

34. A pharmaceutical formulation comprising a therapeutically effective amount of the composition claimed in any one of the claims 8-17, and a pharmaceutically acceptable carrier.
- 5 35. A method of treatment of a disorder or disease, comprising administering to a patient in need of the treatment a therapeutically effective amount of the pharmaceutical formulation as claimed in claim 33 or 34.
36. A method for producing a liposomal vaccine comprising the steps of: preparing phospholipid multilamellar vesicles and encapsulating water-soluble immunogen and/or immunomodulating substances, whereby the liposomes have a high lipid to protein ratio.
- 10 37. The method of claim 35 wherein the ratio ranges from about 50 to 1000.
38. The method of claim 36 wherein the ratio is about 300.
39. A liposomal composition of high lipid to protein weight ratio comprising an immunogenic construct of immunogenic carrier conjugated to peptide selected from the group consisting of SEQ ID NO: 17, 18, 19, and 20.
- 15 40. A method for producing liposomal vaccine containing high doses of immunogen comprising rehydrating a lyophilized lipid complement with water or an aqueous ethanol solution, at which step an immunogen is contained either in the lipid complement or the aqueous ethanol solution.